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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/883,207	06/19/2001	Tuqiang Ni	015290-504	9862

7590

05/13/2003

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EXAMINER

DEO, DUY VU NGUYEN

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 05/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/883,207

Applicant(s)

NI ET AL.

Examiner

DuyVu n Deo

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 April 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang et al. (US 6,403,488), Bobbio et al. (US 4,615,764), and Khajehpour et al. (US 6,117,786).

Yang describes a method for etching oxide layer including BPSG and low-k materials, useful in a SAC etch process, with a plasma that are formed from gases such as CHF₃, SF₆ (sulfur-containing gas), and carrier gas, Ar (col. 2, line 62-col. 3, line 10). Unlike claimed invention, Yang doesn't describe the plasma including oxygen-containing gas. Bobbio describes an etching method for oxide where he teaches of adding oxidizing components including O₂ and SO₂ (sulfur-containing gas) (ab.; summary). It would have been obvious for one skilled in the art at the time of the invention in light of Bobbio to add oxidizing components including O₂ and SO₂ (sulfur-containing gas) in order to enhance etching selectivity of the oxide (ab.). Furthermore, profile control of the etched openings (straight openings) by controlling the amount of oxidizing components are known to one skilled in the art as described by Khajehpour (col. 3, line 20-25). Therefore, one skilled in the art would find it obvious to control the amount of the etching components such as O₂ and SO₂ (sulfur-containing gas) in order to control the profile the etched openings.

Art Unit: 1765

Referring to claim 3, since the etchant above are the same as the claimed invention, they would also provide the same effect as those cited in claim 3.

Referring to claim 14, Yang describes the openings aspect ratio is preferable $>4:1$ and the size of the opening is less than $0.3\text{ }\mu\text{m}$ (col. 6, line 31-36). Even though he doesn't describe the depth is at least $2\text{ }\mu\text{m}$ (claim 15) nor the aspect ratio of at least $10:1$ (claim 17); however, it would have been obvious for one skilled in the art to determine the optimum depth and aspect ratio through routine experimentation depending on the type of device structure being processed to provide an opening with a reasonable expectation of success. Khajehpour describes an opening having depth greater than $2\text{ }\mu\text{m}$ (col.4, line 35).

Referring to claims 4, 5, Yang describes conventional reactor having RF or dual RF and reactor such as microwave magnetic etcher, HDP can be used (col. 6, line 6-31). Khajehpour also describe reactor having RF energy applied to the top and bottom electrode for etching (col. 4, line 62-col. 5, line 5).

Referring to claim 6, Khajehpour suggests oxygen supplied at 3-15 sccm in order to obtain straight sidewalls (col. 3, line 37-52). This amount would be effective to provide undissociated SO_2 molecules that would prevent etc stop under bombardment of directional ions.

Referring to claims 8, 18, 19, Yang describes that the etching conditions are those typically used for oxide etching and they includes a P of 60-200 mTorr, etching gas flow rate of 15-50 sccm, Ar flow rate of 0-500 sccm (col. 5, line 37, 45, 52). Other conditions are disclosed by Khajehpour, in which depending on the reactor being used. He describes a P of less than 200 mTorr and substrate support T of -10 to 40 degrees Celsius (col. 4, line 36-62), a top power

of 1000 watts, and a bottom power of 2000 watts, flow rate of etching gas such as C₄F₈ at 5-8 sccm, and O₂ at 3-15 sccm (col. 3, line 37-52; col. 4, line 27).

Referring to claims 7, 12, 13, 18, 19, unlike claimed invention, above prior art doesn't describe flow rate of SO₂ and the flow ratio between O₂ and SO₂. However, since both are oxidizing components and Khajehanouri teaches that it is desirable to control oxygen addition in order to obtain straight sidewalls which are about 3-15 sccm (col. 3, line 38-48). Therefore, it would have been obvious to one skilled in the art to determine the flow rate of SO₂ through routine experimentation in order to obtain the optimum flow rate of SO₂ in order to obtain straight sidewalls with a reasonable expectation of success.

Response to Arguments

3. Applicant's arguments filed 4/8/03 have been fully considered but they are not persuasive.

Referring to applicant's argument that Yang teaches away from adding oxygen because he describes that CO may be formed but preferably CO is not added to the gas mixture. This is found unpersuasive because this is not teaching away not teaching another way since preferred embodiments and disclosed examples and uses do not constitute a teaching away from less preferred or nonpreferred embodiments. See *In re Susi*, 440 F.2d 442, 169 USPQ 423 (CCPA 1971).

Referring to applicant's argument that neither Yang nor Bobbio teaches a gas mixture including C_xF_yH_z, SO₂ and an oxygen containing gas is acknowledged. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references.

Art Unit: 1765

See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).


Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 703-305-0515.

DVD
May 13, 2003


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